

# MATERIAL SAFETY DATA SHEET

## 1. SUBSTANCE AND SOURCE IDENTIFICATION

National Institute of Standards and Technology  
Standard Reference Materials Program  
100 Bureau Drive, Stop 2320  
Gaithersburg, Maryland 20899-2320

SRM Number: 3126a  
MSDS Number: 3126a  
SRM Name: Iron Standard Solution

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Description: This Standard Reference Material (SRM) is intended for use as a primary calibration standard for the quantitative determination of iron. One unit of SRM 3126a consists of 50 mL of a single element solution in a high-density polyethylene bottle sealed in an aluminized bag. The solution is prepared gravimetrically to contain a known mass fraction of iron. The solution contains nitric acid at a volume fraction of approximately 10 %.

**Material Name:** Iron Standard Solution

### Other Designations:

**Iron:** Fe; ferrum; ferrous iron; elemental iron

**Iron Nitrate:** Iron trinitrate; iron (III) nitrate; ferric nitrate; nitric acid, iron salt

**Nitric Acid:** Aqua fortis; hydronitrate; azotic acid; engraver's acid.

## 2. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Component	CAS Registry	EC Number (EINECS)	Concentration (%)
Nitric Acid	7697-37-2	231-714-2	10
Iron Nitrate	10421-48-4	233-899-5	3.97
Iron	7439-89-6	231-096-4	1

**EC Classification, R/S Phrases:** Refer to Section 15, Regulatory Information.

## 3. HAZARDS IDENTIFICATION

**NFPA Ratings (Scale 0-4):** Health = 4      Fire = 0      Reactivity = 2

**Major Health Hazards:** Nitric acid can cause severe or fatal burns if inhaled, swallowed, or absorbed through the skin. A large dose of iron, or chronic exposure to iron, can damage the kidneys, liver, pancreas, GI tract, and other organs. Ingestion of iron nitrate or other inorganic nitrates may cause severe illness or death.

**Physical Hazards:** None documented for this mixture. Container may rupture.

## Potential Health Effects

<b>Inhalation:</b>	Nitric acid, if inhaled, can damage the mucous membranes and respiratory tract, causing spasm, inflammation of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting. Inhalation of iron nitrate, other ferric salts, or iron dust can irritate the upper respiratory tract.
<b>Skin Contact:</b>	Nitric acid can cause severe skin burns. Effects of acid burns may be delayed. Iron nitrate can cause skin irritation and dermatitis.
<b>Eye Contact:</b>	Nitric acid can cause severe eye irritation, corneal burns, permanent eye damage, or blindness. Iron or iron nitrate can cause eye irritation and burns, brown discoloration, blurred vision, and conjunctivitis.
<b>Ingestion:</b>	Nitric acid can cause severe burns and damage to the GI tract. Ingestion of iron nitrate can cause pain in the mouth and throat, followed by vomiting and diarrhea; kidney and liver damage may occur.

**Medical Conditions Aggravated by Exposure:** The mixture may aggravate pre-existing disorders of the eyes, skin, GI tract, and respiratory tract. In addition, large amounts of iron can aggravate a number of conditions including hemosiderosis, hemochromatosis, porphyria, stomach ulcer, kidney disease, or liver disease.

### Listed as a Carcinogen/ Potential Carcinogen:

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens	_____	<u>  X  </u>
In the International Agency for Research on Cancer (IARC) Monographs	_____	<u>  X  </u>
By the Occupational Safety and Health Administration (OSHA)	_____	<u>  X  </u>

**Note:** Large doses of iron may cause tumors in rat, but neither elemental iron nor iron nitrate is presently classified as a human carcinogen.

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## 4. FIRST AID MEASURES

**Inhalation:** Move the person to fresh air immediately. If not breathing, qualified personnel may start CPR or give oxygen if necessary. Get medical aid at once, and bring the container or label.

**Skin Contact:** Remove contaminated clothing and shoes. Flush affected skin with water for at least 15 minutes, then wash thoroughly with soap and water. If burns are severe or if skin irritation persists, get medical aid and bring the container or label. Wash contaminated clothing before reusing.

**Eye Contact:** Remove contact lenses (if any). Do not allow victim to rub eyes or keep eyes closed. Flush eyes with large amounts of running water for at least 30 minutes, keeping eyelids open and raising lids to remove all chemical. Get medical aid at once, and bring the container or label.

**Ingestion:** Contact a poison control center immediately for instructions. Wash out mouth with water, but do not induce vomiting. Get medical aid at once, and bring the container or label.

**Note to Physician (Nitric Acid):** Wash affected skin with 5% solution of sodium bicarbonate (NaHCO<sub>2</sub>). Activated charcoal is of no value. Do not give bicarbonate to neutralize the material.

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## 5. FIRE FIGHTING MEASURES

**Fire and Explosion Hazards:** No data are available for this mixture. Nitric acid does not burn, but it is a powerful oxidizing agent that can react with combustible materials to cause fires. Iron nitrate is also a strong oxidizer that may ignite on contact with combustible materials.

**Extinguishing Media:** Use extinguishing media appropriate to the surrounding fire: water spray, dry chemical, carbon dioxide, or foam. Use a water spray to dilute nitric acid and to absorb liberated oxides of nitrogen. (These guidelines apply to the mixture; when the components are considered separately, different precautions may apply.)

**Fire Fighting:** Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH-approved self-contained breathing apparatus (SCBA).

**Flash Point (°C):** N/A

**Autoignition (°C):** N/A

**Flammability Limits in Air:** N/A

**Lower Explosive Limit (LEL):** N/A

**Upper Explosive Limit (UEL):** N/A

**Flammability Class (OSHA):** N/A

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## 6. ACCIDENTAL RELEASE MEASURES

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**Occupational Release:** Notify safety personnel of spills. Surfaces contaminated with this material should be covered with soda ash or sodium bicarbonate to neutralize the acid. Place the neutralized material into containers suitable for eventual disposal, reclamation, or destruction.

**Disposal:** Refer to Section 13, Disposal Considerations.

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## 7. HANDLING AND STORAGE

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**Storage:** Store unopened containers of this material in a dry place at room temperature. Protect from physical damage, heat, and light, and isolate from incompatible materials. Use opened containers immediately or discard.

**Safe Handling Precautions:** Wear gloves and chemical safety goggles (Section 8). Engineering controls should maintain airborne concentrations below TLV (Section 8).

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## 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

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### Nitric Acid:

ACGIH TLV-TWA: 2 ppm or 5 mg/m<sup>3</sup>  
OSHA TLV-TWA: 2 ppm or 5 mg/m<sup>3</sup>

### Iron Nitrate:

ACGIH TLV-TWA: 1 mg/kg  
OSHA TLV-TWA: 1 mg/kg

### Iron:

ACGIH TLV-TWA: 10 mg/m<sup>3</sup> (iron oxide dust and fume as Fe)  
OSHA TLV-TWA: 5 mg/m<sup>3</sup> (iron oxide dust and fume as Fe)

**Ventilation:** Use local or general exhaust to keep employee exposures below limits. Local exhaust ventilation is preferred because it can control contaminant emissions at the source, preventing dispersion into the general work area. Refer to the ACGIH document *Industrial Ventilation, a Manual of Recommended Practices*.

**Respirator:** If necessary, refer to the NIOSH document *Guide to the Selection and Use of Particulate Respirators Certified under 42 CFR 84* for selection and use of respirators certified by NIOSH.

**Eye Protection:** Use chemical safety goggles where dusting or splashing of solutions may occur. See OSHA standard (29 CFR 1910.133) or European Standard EN166. The employer should provide an emergency eye wash fountain and safety shower in the immediate work area.

**Personal Protection:** Wear appropriate gloves and protective clothing to prevent contact with skin.

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## 9. PHYSICAL AND CHEMICAL PROPERTIES

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Nitric Acid	Iron Nitrate	Iron
<b>Appearance and Odor:</b> Colorless to slightly yellow liquid, darkens to brown upon aging and exposure to light; irritating, pungent odor.	<b>Appearance and Odor:</b> Deliquescent solid.	<b>Appearance and Odor:</b> Silver-white to gray metal, chips, or powder.
<b>Relative Molecular Weight:</b> 63.02	<b>Relative Molecular Weight:</b> 241.87	<b>Relative Molecular Weight:</b> 55.847
<b>Molecular Formula:</b> HNO <sub>3</sub>	<b>Molecular Formula:</b> Fe(NO <sub>3</sub> ) <sub>3</sub>	<b>Molecular Formula:</b> Fe
<b>Specific Gravity:</b> 1.0543 (10%)	<b>Specific Gravity:</b> 1.684	<b>Specific Gravity:</b> 7.86
<b>Solvent Solubility:</b> Decomposes in alcohol	<b>Solvent Solubility:</b> Soluble in alcohol and acetone.	<b>Solvent Solubility:</b> Soluble in organic acids
<b>Water Solubility:</b> Soluble	<b>Water Solubility:</b> Highly soluble	<b>Water Solubility:</b> Insoluble
<b>Boiling Point:</b> 86 (187°F)	<b>Boiling Point:</b> <100°C (212°F), decomposes	<b>Boiling Point:</b> 2730 (4946°F)
<b>Vapor Density (Air=1):</b> 2.17	<b>Vapor Density (Air=1):</b>	<b>Vapor Density (Air=1):</b>
<b>pH:</b> 1.0 (0.1M solution)	<b>pH:</b>	<b>pH:</b> Neutral

**NOTE:** The physical and chemical data provided are for the pure components. No physical or chemical data are available for this solution of iron and nitric acid. The actual behavior of the solution may differ from the individual components.

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## 10. STABILITY AND REACTIVITY

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**Stability:**      X   Stable               Unstable

Stable at normal temperatures and pressure.

**Conditions to Avoid:** Contact with combustible or incompatible materials.

**Incompatible Materials:**

Nitric Acid: Incompatible with numerous materials including organic materials, plastics, rubber, chlorine, and metal ferrocyanide.

Iron Nitrate: Incompatible with metals, combustible materials, cyanides, reducing agents, and acids.

Iron: Incompatible with strong acids.

**Fire/Explosion Information:** See Section 5.

**Hazardous Decomposition:** Thermal decomposition of nitric acid or iron nitrate can produce nitrogen oxides, including nitric oxide (NO), nitrogen dioxide (NO<sub>2</sub>), and nitrous oxide (N<sub>2</sub>O). Nitric acid mist or vapor may also be produced. Thermal decomposition of iron may release toxic or hazardous gases.

**Hazardous Polymerization:** \_\_\_\_\_ Will Occur      X   Will Not Occur

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## 11. TOXICOLOGICAL INFORMATION

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**Route of Entry:**      X   Inhalation                        X   Skin                        X   Ingestion

### Nitric Acid:

Human, oral: LD<sub>Lo</sub> = 430 mg/kg

Rat, oral: LD<sub>50</sub> > 90 mg/kg

Rat, inhalation: LC<sub>50</sub> (4 hrs) = 130 mg/m<sup>3</sup>

### Iron Nitrate:

Rabbit, oral: LD<sub>Lo</sub> = 3250 mg/kg

### Iron:

Rat, oral: LD<sub>50</sub> = 30 g/kg

**Target Organ(s):** Respiratory tract, eyes, skin, GI tract, kidneys, liver.

**Mutagen/Teratogen:** Nitric acid has caused birth defects in animals under experimental conditions, and has also been investigated as a possible mutagen. Elemental iron and iron nitrate are not classified as reproductive hazards.

**Health Effects:** See Section 3.

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## 12. ECOLOGICAL INFORMATION

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### Nitric Acid, Ecotoxicity Data:

Green shore crab (*Carcinus maenas*): LC<sub>50</sub> (48 hrs) = 180,000 µg/L

Starfish (*Asterias rubens*): LC<sub>50</sub> (48 hrs) = 100,000 to 330,000 µg/L

Hooknose (*Agonus cataphractus*): LC<sub>50</sub> (48 hrs) = 100,000 to 330,000 µg/L

Brook trout (*Salvelinus fontinalis*): NR-LETH = 1,562 µg/L

Cockle (*Cerastoderma edule*): LC<sub>50</sub> (48 hrs) = 330,000 to 1,000,000 µg/L

### Iron Nitrate, Ecotoxicity Data:

Green swordtail (*Xiphophorus helleri*): NOEC (84 days) = 10 mg/L

### Iron, Ecotoxicity Data:

Carp (*Cyprinus carpio*): LC<sub>50</sub> (96 hrs) = 2,250 µg/L

Channel catfish (*Ictalurus punctatus*): LC<sub>50</sub> (96 hrs) = 500,000 µg/L

Mayfly (*Leptophlebia marginata*): LC<sub>50</sub> (24 days) = 73,070 µg/L

**Environmental Summary:** The components of this mixture are moderately toxic to some aquatic organisms. Large spills should not be released to the environment.

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### 13. DISPOSAL CONSIDERATIONS

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**Waste Disposal:** One or more components of this mixture are classified as RCRA hazardous waste. Dispose of container and unused contents in accordance with federal, state, and local requirements for acid waste, which vary according to location. Decontaminate containers before recycling. Processing, use, or contamination of this product may change the waste management options.

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### 14. TRANSPORTATION INFORMATION

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**U.S. DOT and IATA:** Nitric Acid: Hazard Class 8, UN2031, Packing Group II

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### 15. REGULATORY INFORMATION

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#### U.S. REGULATIONS

CERCLA Sections 102a/103 (40 CFR 302.4):

Nitric Acid: RQ = 1000 lb.

Iron Nitrate: Not regulated

Iron: Not regulated

SARA Title III Section 302: Nitric acid is regulated

SARA Title III Section 304: Nitric acid is regulated

SARA Title III Section 313: Nitric acid is regulated; iron nitrate is regulated as N511, Nitrate Compounds.

OSHA Process Safety (29 CFR 1910.119): Nitric acid at higher concentrations ( $\geq 94.5\%$ ) is regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE: Yes

CHRONIC: Yes

FIRE: No

REACTIVE: Yes

SUDDEN RELEASE: No

#### STATE REGULATIONS

CA Proposition 65: None of the components are regulated.

NJ and PA Right to Know Lists: Nitric acid is regulated.

#### CANADIAN REGULATIONS

WHMIS Classification:

Nitric Acid: C (oxidizing material), D1A (very toxic material), E (corrosive material)

Iron Nitrate: C (oxidizing material), D2B (toxic material)

Iron: D2B (toxic material).

WHMIS Ingredient Disclosure List:

Nitric Acid: Regulated.

Iron Nitrate: Regulated as Iron, Water-Soluble Salts, n.o.s.

CEPA Domestic Substances List (DSL): All three components are regulated.

#### EUROPEAN REGULATIONS

EU/EC Classification:

Nitric Acid: O (Oxidizer), C (Corrosive)

Iron Nitrate: O (Oxidizer); not classified in Annex I of Directive 67/548/EEC; not on a priority list.

Iron: XN (Harmful); not classified in Annex I of Directive 67/548/EEC; not on a priority list.

Risk Phrases (mixture):

R23 (toxic by inhalation)  
R25 (toxic if swallowed)  
R34 (causes burns)  
R36/37/38 (irritating to eyes, respiratory system and skin)

Safety Phrases (mixture):

S20/21 (when using, do not eat, drink or smoke)  
S28 (wash after contact with skin)  
S45 (in case of accident or illness, see doctor; show label)  
S60 (dispose of this material and its container as hazardous waste)

**NATIONAL INVENTORY STATUS**

U.S. Inventory (TSCA): All components are listed.

TSCA 12(b), Export Notification: No components are listed.

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**16. OTHER INFORMATION**

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**Sources:**

Hazardous Substances Data Bank (HSDB): Ferric Nitrate.

IUCLID Chemical Data Sheet: Iron. European Chemicals Bureau, 19 February 2000.

IUCLID Chemical Data Sheet: Iron Trinitrate. European Chemicals Bureau, 19 February 2000.

IUCLID Chemical Data Sheet: Nitric Acid. European Chemicals Bureau, 19 February 2000.

PAN Pesticide Database: Iron.

PAN Pesticide Database: Nitric Acid.

U.S. National Institute for Occupational Safety and Health, *NIOSH Pocket Guide to Chemical Hazards*, June 1990 edition. DHHS (NIOSH) Publication No. 90-117.

**Disclaimer:** Physical and chemical data contained in this MSDS are provided only for use as a guide in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data in the MSDS. The certified values for this material are given in the NIST Certificate of Analysis.